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UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

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Stand Improvement
Impnira

March 23, 1934.

INSTRUCTIONS AND INFORMATION
CONCERNING
STAND IMPROVEMENT WORK
California Region



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Instructions and Information Concerning Stand Improvement Work
California Region

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Stand Improvement
Improvement

March 23, 1934

INSTRUCTIONS AND INFORMATION CONCERNING STAND IMPROVEMENT WORK

CALIFORNIA REGION

I. INTRODUCTION

The purpose of this circular is to serve as a guide in stand improvement operations designed to improve growth and quality of stands on cut-over areas. It is not intended to take the place of the specific plans necessary for carrying out each project.

The principles and technique described here have been developed largely from the experience gained on three small stand improvement projects conducted in the fall of 1933. It is quite possible that stand improvement may become a regular part of our work. If this proves to be the case, this circular must be revised in the light of the coming season's experience. Field men should overlook no opportunity to secure records of costs, accomplishments and technique that will be of value in planning future work.

II. GENERAL PRINCIPLES

(1) Area Selection

The principal objective of improvement cuttings should be the bettering of growing conditions for the most valuable species on the best and most accessible sites on cut-over areas in the National Forests. These will usually be in the ponderosa pine, sugar pine - ponderosa pine, and sugar pine - ponderosa pine - fir types. Some of the areas selected may be of comparatively low site quality. The East Side ponderosa pine at Lasco on the Lassen Forest is an example. In these cases the excellent logging conditions, high percentage of pine, and the high degree of accessibility to highways and railroad compensate for the slower growth. On the other hand, some areas will be selected that are relatively inaccessible without heavy investments for development. Proposed projects on the Sierra and Stanislaus are examples. These areas are well stocked with valuable species and are among the best timber growing sites in California.

Only areas dedicated to timber production will be selected for treatment. (Except one Christmas tree project). Improvement of recreation areas and roadside treatment are not contemplated in this line of work.

(2) Stand Selection

"Stand" is a general descriptive term referring to a portion of the forest in which condition, age composition and species composition are relatively uniform throughout. A stand may cover many acres or only a fraction of an acre. Its boundaries may be distinct, or one stand may blend into another. After a general cut-over area has been selected for treatment, the problem narrows down to selection of those stands upon which work should be done. Where improvement cutting would mean the protection of valuable trees against the crowding of less valuable ones, and the stimulation of growth in a stand which is stagnating from overcrowding, such work is warranted. On the other hand, no work should be done in stands of the following descriptions:

- (a) Stands in which, because of the heavy reserve stand, little or no release of the advance reproduction would occur.
- (b) Stands that are already understocked.
- (c) Portions of the area where reproduction is reclaiming brush fields. In this case a heavier than normal stand will hasten the destruction of brush.
- (d) Stands composed entirely of inferior species, unless some special or local market for that species exists.

Cases will often occur where the funds available are not adequate to treat all of the stands upon which we feel work is justified. While no rigid rule can be applied, in general the following order of priority should be observed:

- (a) Stands not yet past the sapling¹ stage. Cutting in these stands often constitutes the most valuable treatment that can be applied during the entire life of the stand. Benefits extend through the whole rotation, particularly when large numbers of young trees of inferior species are removed.
- (b) Stands of scattered, defective, unmerchantable, old-growth trees that spread disease and impede or prevent the development of a young and vigorous stand. This condition is common on land exchange areas.
- (c) Pole stands. Individual trees here are so large that cutting is expensive and fire hazard and insect menace become problems of considerable proportions. Thinings in these stands lose their effectiveness as the stands grow older and competition between individuals again becomes severe.

¹A sapling is a tree over 3 feet high and under 4 inches d.b.h.

(3) Tree Selection

In a given stand, certain species and certain individual trees are more desirable than others. Promoting the development of desirable species and individuals is the general object of tree selection.

The specific objects of tree selections are:

- (a) To increase the proportions of valuable species in the stand.
- (b) To improve the form and value of the trees.
- (c) To increase the yield of the final product.
- (d) To secure the most rapid growth compatible with a full stand and good quality.

These objects are accomplished through retention of the best trees in the stand, taking into account species, form and vigor, and position.

The relative desirability of different species varies somewhat in different types, but in general sugar pine, ponderosa pine, incense cedar, Douglas fir, and white fir should be favored in the order named. Douglas fir near established local markets may be entitled to preference over cedar.

Between two individuals of almost the same priority, sugar pine and ponderosa pine on the Shasta, for instance, the best individual from the standpoint of form and vigor will be left. The desired form and vigor is most characteristically found in dominant trees. These trees have a well developed crown and are usually the most vigorous, as indicated by the annual height growth between whorls. It will often be necessary to select co-dominants or intermediates to leave in order to secure sufficient stocking. Such trees should be vigorous enough to profit by release and come into a dominant position in the crown canopy.

Selection of trees according to position will be covered under a discussion of spacing. The point that needs elaborating here is the necessity of taking care that, in areas where thickets alternate with openings, no trees are cut that reduce the canopy area of the thickets. This may result in leaving some trees otherwise not very desirable.

In releasing the selected trees no more trees should be cut than are necessary to free the desired trees from competition. Where the less desirable individuals are not actually overtopping the desirable trees or restricting the lateral development of crowns of desirables, or threatening to do so within a decade, they should be left to keep the ground covered. Most of them will be shaded out later by the better trees. There is a temptation to cut more than is necessary and thereby increase the cost beyond what is justified. Trees of inferior species, crooked trees, and trees with malformed crowns, dead leaders and bad scars are undesirable when in competition with desired trees, but when more or less isolated should be allowed to stand. However, so far as practicable, diseased trees, which are sources of infection that endanger the stand, should be eliminated.

(4) Spacing in Young Stands

Exact spacing of trees is usually impracticable and is not sought as an end in itself. The governing principle is to see that each tree has room to develop properly and to provide that the available growing space shall be utilized as far as possible by trees of desired species form and condition. Bear in mind that there is apt to be a higher mortality in small trees than in large ones. Remember also that it is not anticipated that the increased growth rate, which results from thinning, will be sustained for over twenty or thirty years.

Complete sudden exposure in midsummer of pines occurring as under-story in fir thickets appears to be inadvisable. Tall spindling saplings left after the removal of supporting trees, tend to droop and often acquire yellow foliage. They will probably be very subject to snow injury. In dealing with such trees a lighter thinning than would otherwise be desirable should be made.

The following table will serve as a guide in securing correct spacing in the majority of cases. A close approximation of the table can be secured by application of this rule: Allow 6-foot spacing for trees averaging one inch d.b.h. and add one-half foot to spacing for each increase of one inch average d.b.h. Where the trees average less than $4\frac{1}{2}$ feet in height the spacing should be roughly equivalent to the average height of the trees.

<u>Average d.b.h. of trees to be released</u>	<u>Average height of trees to be released, in ft.</u>	<u>Approximate spacing in feet</u>	<u>Number of trees left per acre in fully stocked stands</u>
0	$4\frac{1}{2}$	$5\frac{1}{2}$	1440
1	8	6	1210
2	12	$6\frac{1}{2}$	1031
3	16	7	889
4	20	$7\frac{1}{2}$	774
5	24	8	680
6	28	$8\frac{1}{2}$	603
7	33	$9\frac{1}{2}$	482
8	38	10	436
9	43	$10\frac{1}{2}$	395
10	48	11	360
11	51	$11\frac{1}{2}$	329
12	54	12	302

The last column in the table will be of value in checking work completed to see how closely the optimum spacing has been attained. The only trees considered are those selected for release and deliberately left. Undesirable neutral trees, left only because they exert no ill effect on desirable neighbors, should not be considered in arriving at spacing and number of trees per acre.

In applying the spacing rules the approximate spacing is taken to mean the average distance between a selected tree and its three nearest neighbors. For instance, a tree with other trees 12, 8 and 4 feet away, would have an average spacing of 8 feet, the proper spacing for trees averaging 5 inches d.b.h. In making this calculation no tree at a distance of over double the recommended spacing will be included.

It should be emphasized again that spacing is not an end in itself. Principal attention should be directed to the requirements for crown space of the desirable trees, keeping in mind that these are not final crop trees and that subsequent improvement cuttings will probably be made.

III. CLASSIFICATION OF STAND IMPROVEMENT TREATMENT

The two main classifications of the work, cleaning and improvement cutting, are based upon the size of the material treated. Improvement cuttings are further subdivided according to the primary purpose of the work.

(1) Cleaning

A cleaning is a cutting made in a stand not yet past the sapling stage for the purpose of removing trees of undesirable species or form that are injuring, or are likely to injure promising trees. Syn: Weeding.

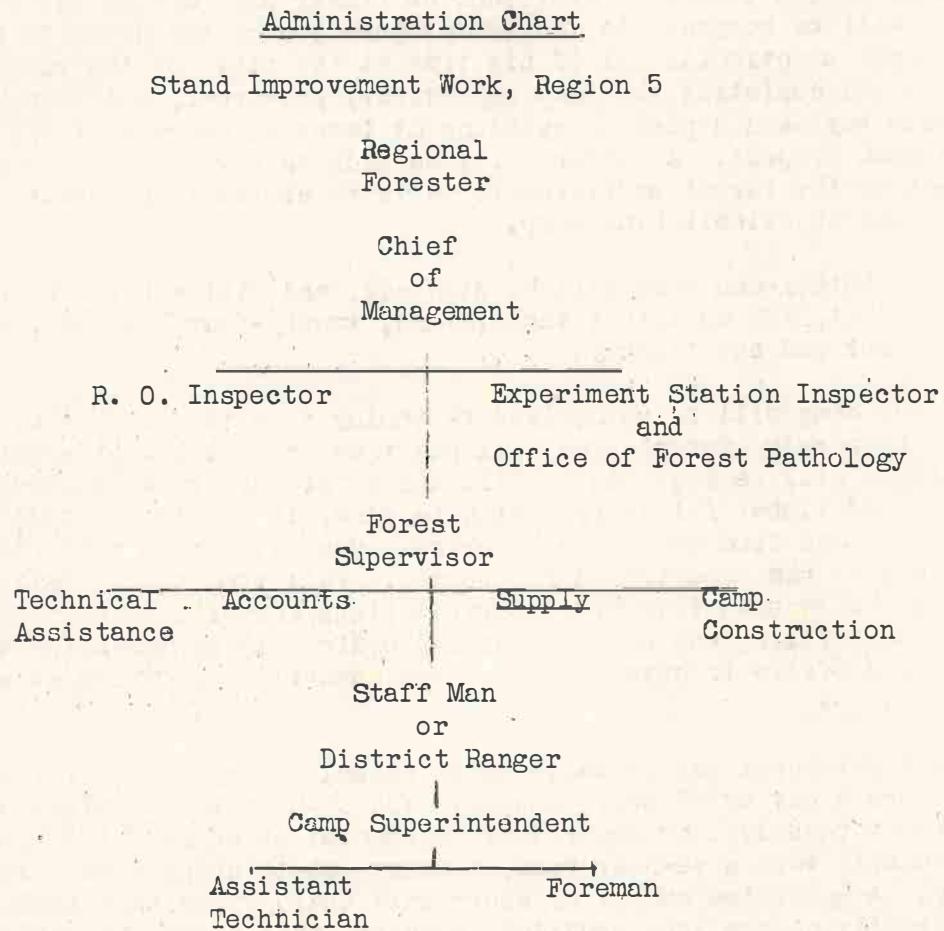
(2) Improvement Cutting

An improvement cutting is a cutting in a stand which has passed the sapling stage, the main object of which is to remove trees of undesirable species, form and condition. These cuttings are further subdivided into:

- (a) Thinning - An improvement cutting in immature stands made for the purpose of increasing the growth rate of the remaining trees.
- (b) Liberation cutting - An improvement cutting by which young growth is freed from oppression by removal of undesirable trees which occupy more room than their silvicultural value warrants (wolf trees).
- (c) Sanitation cutting - An improvement cutting made for the purpose of removing diseased trees.
- (d) Snag disposal - Cutting of dead trees over 12 inches d.b.h. and twenty feet high.

IV. ADMINISTRATION

The set-up for the administration of this work can best be shown by the following diagram:



The Chief of Management, in addition to approving projects and preparing general plans and instructions for the work, makes the allotments, orders the equipment that can not be better ordered or purchased locally, and selects the camp superintendents and assistant technicians. The forest supervisor hires the labor and is responsible for the conduct of the work, for camp construction, administration, supply and accounts. Experiment station men and regional office inspectors will ordinarily function in advisory capacities. However, if they feel that an emergency demands immediate changes in either administration or technique, they have the authority and are expected to make these changes on the ground. Before any such changes are made, the supervisor or his representative will be contacted if possible. Inspection memoranda should be prepared and distributed in accordance with usual Forest Service practice.

The decision as to whether a supervisor's staff man or a district ranger should be put in charge of this line of work must be made by the supervisor. Where the ranger has the necessary training and background it is highly desirable that he give the work a good deal of attention. However, in view of the present heavy demands on a ranger's time, and the desirability of specialized technical supervision over this work, it is probable that the supervisor will often delegate the direct supervision of this work to a technical assistant or timber sale man on his staff. This man will be responsible for the preparation of the detailed project plans, spend practically all of his time at the start of the season in instructing and assisting the camp supervisory personnel, and when work is well under way should plan on spending at least an average of one day a week on each project. An effort will be made to have the camp supervisory personnel on the forest sufficiently early to assist in preparing the working plan and in establishing camp.

The thirty-man camp will be standard, and will consist of a camp superintendent, two assistant technicians, twenty-four laborers, one cook, one bull cook and one flunkey.

Each camp will be authorized to employ from two to four of the laborers as working foremen and will pay these men at the strawboss rate. Although men will be required to fill the duties of truck drivers, tool sharpener and timber faller from time to time, it should be possible to secure these men from among the laborers. Men with these qualifications can be paid at the experienced labor rate. Full time timber fallers should, of course, be secured from Civil Service lists and will receive 75 cents an hour. Saw-filing can best be handled ordinarily by arranging with the supervisor's office to have the saws from several camps filed at a central point.

All personnel except those on an annual salary basis will work not over 8 hours a day or 40 hours a week. The 40-hour week limitation does not apply to technical or supervisory personnel on an annual salary basis. These men will work a 44-hour week, 4 hours constituting a full day on Saturday. A specified number of hours work daily means that number of hours actually on the job, provided, however, that where the total travel time to and from work exceeds two hours daily the amount of such excess will be considered a part of the hours of daily work. Lunch time will not be included as a part of the required work hours.

V. GENERAL PRACTICES

Marking

Until field crews become skilled, all classes of work will result more satisfactorily if the trees are marked for cutting. Either the trees to be left or the trees to be removed may be marked. In dense stands, it is cheaper to mark the trees to be left. Red crepe paper cut into strips

one inch wide has been proved very satisfactory for marking. After cutting crews become acquainted with the principles of stand improvement, the marking in sapling stands can be eliminated. An arrangement that has worked well in these stands is to send the first crew of cutters through with instructions to cut conservatively, leaving doubtful trees. The foreman follows this crew with two or three cutters who complete the operation under his direct supervision.

A good way to train the cutting crews is to use part of the crew as markers. The marking can then be checked and the necessary corrections made. If a man appears unable to grasp the principles of stand improvement while marking, it seems probable that he will be a very poor man to trust with a brush hook in an unmarked stand.

Improvement cutting in stands which have passed the sapling stage will be more satisfactory if all trees to be removed are marked. All sanitation trees and trees of merchantable size which are to be removed will be marked for cutting.

Organization of Field Work

The number of men under a foreman may vary from four to fifteen, depending upon the type of work done and the quality of the labor available. Since damage to young growth may result from the felling of large trees, a special felling crew should precede the cutting crew, taking down snags and trees over 8 inches d.b.h., which are to be removed. These men will be equipped with felling saws and axes. The cutting crew will be furnished swamping axes or brush hooks. Where some form of slash disposal, other than lopping and scattering, is necessary, a third crew will handle slash disposal.

Tools

The bulk of the work in sapling stands can be done with the Collins brush hook. Wherever used properly this tool has proved preferable to the axe for cutting material running up to six or eight inches on the stump. The proper use of a brush hook demands a technique somewhat different from an axe and each man, as he comes on the job, should be instructed just how to handle the tool.

For trees over eight inches on the stump and for felling snags, wedges, sledges, felling axes and felling saws are recommended. Swamping axes are suggested for the use of brush pilers.

An important responsibility of camp superintendents and forest staff men will be trying out new tools in this work. A great deal remains to be learned about the best tools for different types of treatment and size of material. Pruning shears, pruning saws and power saws have possibilities that should be thoroughly explored. Unfamiliarity with the new tools should not be accepted as adequate reason for continuing to use conventional methods when these methods can not be demonstrated to be the most efficient.

Special Problems

Several special problems come up in improvement cuttings that are not encountered in cleanings. Cutting in material above four inches d.b.h., especially when in dense stands, creates a mass of slash that is difficult to dispose of and unsafe to leave. Aside from the fire hazard involved, there is real danger of insect infestation, particularly in ponderosa pine. Ips and flat heads breed readily in cut trees of pole size, and in poles over eight inches in diameter the pine bark beetle becomes a menace. Probably the best slash disposal from the insect control standpoint is to pile and burn currently. Lopping, scattering and exposing the bark to the sun as much as possible is next in order of preference. Least desirable of all is the practice of piling in the spring and summer for burning the following fall. These piles furnish ideal breeding places for insects during the summer.

Sanitation cuttings involve the removal of all conky firs and cedars showing shot-hole cups. Trees badly infected with mistletoe should be removed also when their value for other purposes does not outweigh the damage they do by spreading the disease. It frequently happens that seed trees that can not be spared have one or two heavily infected lower branches. In such cases an attempt should be made to remove these branches with a pruning saw, shears or some similar contrivance.

When mistletoe occurs in young stands, all bole infected trees should be removed. Branch mistletoe can be removed by lopping off the infected branch if the tree is desirable otherwise. Pruning shears are particularly adapted to this work.

Liberation cuttings will usually be made in connection with sanitation cutting and will be incidental to it. An exception to this rule is the case of hardwoods. Hardwoods up to six inches d.b.h. will be cut when suppressing desirable pine or cedar. Since all of the hardwoods encountered (oak, madrone and laurel) are vigorous sprouters, it may prove better not to sever them completely, but to slash them and bend them to the ground in a direction away from the trees to be released. This practice is said to result in less sprouting. Hardwoods over six inches d.b.h., if treated, will be girdled, cutting deeply into the wood.

Snag Disposal

Considerable stand improvement work will be done on areas acquired through land exchange and there snags (dead trees) will be much in evidence. Since the cutting of snags is primarily hazard-reduction work, in the strict sense, and since these dead trees are largely neutral in their effect upon the growth of a stand, snag disposal must not become a major part of stand improvement work. As a minimum requirement, all snags which are likely to fall over and damage treated stands, should be cut in advance of the other work. Each plan of work should provide specific instructions regarding this phase of the work designed to secure the maximum benefits from partial snag disposal. In some places, this may take the form of cutting all snags over thirty inches in diameter, for example. On other areas, snags might be felled for 100 feet on each side of roads through the area. In still other

places, the cutting of snags on strips through, or around, the areas, usually on ridges, if such location is possible, might be the most effective plan. Not more than 20 per cent of the available funds for any given timber stand improvement project will be expended on snag disposal.

Slash Disposal

Slash disposal will be worked out on the ground with local administrative officers. A plan for slash disposal should be incorporated in the project plan. The guiding principles in arriving at methods will be:

- (1) Keeping burned acreage to a minimum in case of fire starting.
- (2) Keeping slash disposal costs to a minimum.

In working this question out locally, the following proposals may serve as a starting point for discussion:

- (1) Slash will be piled and burned when material removed exceeds two-thirds of the original stand.
- (2) Natural openings and piling and burning in strips or lanes will be used to break up areas as an aid in fire suppression.
- (3) Slash may be lopped and scattered in those stands where this practice will result in no higher hazard than in the most hazardous areas after piling and burning.
- (4) Slash may be lopped and scattered where the cutting of snags compensates for the extra hazard created by the slash.

VI. RECORDS OF COST AND ACCOMPLISHMENT

In order to plan the work intelligently for present and future projects, so that the men may be distributed to the best advantage and reasonable standards for cost, progress and accomplishment be developed, it is necessary to know approximately

- (1) Which stands will be worked and which will not be worked, the approximate area occupied by each stand and its location.
- (2) How much of the area is occupied by stands needing similar treatment such as seedling, sapling, or pole stands.
- (3) A rough classification as to the relative density of stands such as light, medium or heavy.
- (4) The number of man-hours required to work average acres in the various stands of a given density such as poles, light, etc.

- (5) The number and size of sanitation trees to be removed and their approximate location.
- (6) The number and size of snags to be felled and their approximate location.

In order to check performance on work done and figure costs and results in terms of trees left and trees removed, it will be necessary to know:

- (1) The number of man-hours required to work average acres in the various stands of a given density such as poles, light, etc.
- (2) The composition of the dominants and density of the stands before treatment.
- (3) The composition of the dominants and density of stands after treatment.

Several methods for getting this information economically have been advanced and are being tried out. It seems likely that no one method will prove best for all types and stands. The different systems already tried out will be described in a separate circular which should be available soon after April 1.

VII. OUTLINE FOR A STAND IMPROVEMENT PROJECT PLAN

- (1) Purpose of project.
- (2) Location and time of project.
- (3) Description of area and stand.
- (4) History
 - (a) Logging
 - (b) Fire
 - (c) Insect infestation
 - (d) Previous stand improvement work
- (5) Selection of stands for treatment.
 - (a) Stands on which work will be done. (Show on map)
 - (b) Stands which will not be worked.
 - (c) Order in which work will be done.
- (6) Treatment of stands.
 - (a) Application of general instructions to local project.
 - (b) Special instructions for local conditions.
 - (c) Sanitation work on stands selected for treatment.
- (7) Slash disposal.
 - (a) Show on map type of disposal to be employed on various portions of area.
- (8) Snag disposal.
 - (a) A specific plan for local area correlated with forest plans for hazard and snag disposal.

(9) Camp organization.

- (a) Personnel and size of camp.
- (b) Location of camps in relation to walking distance to work.
- (c) Camp regulations to cover:
 - 1 - Meal time and working hours.
 - 2 - Sanitation.
 - 3 - Families in or near camp.
 - 4 - Fire prevention.
 - 5 - Plan and organization for fire suppression prepared in cooperation with local administrative officers.
Such a plan should consider the policy of:
 - (A) Keeping men in camp over week-ends.
 - (B) If so, should they be required to pay board?
 - (C) Fiscal policy which should be followed in regard to the payment of men when on fire suppression work.

(10) Crew organization.

- (a) Number of strawbosses.
- (b) Number of experienced laborers.
- (c) Number of laborers.

(11) Preparation of maps.

- (a) A base map, scale 4 inches to the mile, should be prepared in advance of the work and should show:
 - 1 - Land status.
 - 2 - Found corners.
 - 3 - Topography and drainage.
 - 4 - Improvements such as roads, trails, logging railroads, telephone lines, firebreaks, guard stations, etc.
 - 5 - Selected camp sites for project.
 - 6 - A division of the area into
 - (A) Stands to be worked. Make best estimates possible.
 - (B) Areas not to be worked, such as brushfields, old growth stands, areas of poor site quality and areas on which reproduction is poor.
 - 7 - Order in which work will progress.
- Note: Most of the data for such a map should be found in the office files and can be supplemented by a preliminary field examination when feasible. Areas less than ten acres need not be shown.

(12) Records of cost and accomplishment.

- (a) Weekly progress of acreage covered to be shown on base map.
- (b) A monthly record of man-hours and accomplishment on various lines of work, such as:
 - 1 - Snag falling.
 - 2 - Sanitation cutting.
 - 3 - Cleaning.
 - 4 - Thinning.
 - 5 - Slash disposal.
- (c) A record by species and tree class (sapling, pole) of the number of trees released and number cut.
- (d) A tally of the snags felled on area.
- (e) A similar tally for sanitation trees felled on area.

VIII. SUMMARY

The principal objective of improvement cuttings is the bettering of growing conditions for the most valuable species on the best and most accessible sites, in national forest cut-over areas. The specific objectives are:

- (1) To increase the proportion of valuable species in the stand.
- (2) To improve the form or value of the trees.
- (3) To increase the yield of the final product.
- (4) To secure the most rapid growth compatible with a full stand and good quality.

The attainment of these objectives involves, successively, area selection, stand selection, tree selection and treatment. This means that considerable preliminary work on the ground must precede actual cutting on any given project.

No more trees should be cut than are necessary to free desirable trees from competition. There is a temptation to cut more than is necessary and thereby increase the cost beyond what is justified.

Field men should overlook no opportunity to secure records on costs, accomplishment and technique that will be of value in planning future work.

APPENDIX

A. Definitions of terms used in this circular. (Society of American Foresters):

Advance growth. Young trees which have sprung up spontaneously in openings in the forest, or under the forest cover before fellings are begun.

Crown class. The crown classes usually distinguished are:

Dominant. Trees with crowns extending above the general level of the canopy and receiving full light from above and partly from the side; larger than the average trees in the stand, and with crowns well-developed but possibly somewhat crowded on the sides.

Co-dominant Trees with crowns forming the general level of the forest canopy and receiving full light from above but comparatively little from the sides; usually with medium-sized crowns more or less crowded on the sides.

Intermediate Trees with crowns below, but still extending into, the general level of the forest canopy, receiving a little direct light from above but none from the sides; usually with small crowns considerably crowded on the sides.

Over-topped Trees with crowns entirely below the general forest canopy and receiving no direct light either from above or from the sides. These may be further divided into oppressed, usually with small, poorly developed crowns, still alive, and possibly able to recover; and suppressed or dying and dead.

Cut-over forest. Forest from which most or all of the merchantable timber has been cut.

Diameter breast high (d.b.h.) The diameter of a tree at $4\frac{1}{2}$ feet above ground.

Even-aged. Applied to a stand in which only small age differences appear, differences varying with the average age of stand. In young stands, age differences should not be more than 10 or 20 years.

Intermediate cuttings or fellings. Cuttings made in a stand between the time of its formation and its final harvest. It includes cleanings, improvement cuttings, and thinnings.

Cleaning. Cutting made in a stand not yet past the sapling stage for the purpose of removing trees of undesirable form or species, which are injuring or are likely to injure those of greater promise.

Syn: weeding.

Improvement cutting. A cutting in a forest which has passed the sapling stage, the main object being to remove trees of undesirable form, condition and species. It is always a felling for the purpose of bringing the stand into better condition for silvicultural management.

Liberation cutting. An improvement cutting by which young growth is freed from oppression by removal of wolf trees.

Thinning. A cutting made in immature stands after the sapling stage for the purpose of increasing the rate of growth of those trees which are left. Degrees of thinning may be gauged by volume and by number of trees removed.

Intolerant. Incapable of enduring much shade.

Normal stand. A stand fully stocked and in proper growing conditions, conforming to the yield table and having normal increment.

Reserve. A tree or group of trees left uncut on an area for a period, usually a second rotation, after the stand is reproduced naturally or artificially.

Second growth. Forest growth which comes up naturally after cutting, fire or other disturbing cause.

Site class. A designation of the relative productive capacity or quality of different sites with reference to the species employed; the volume or the height produced at a given age being used as a standard for classification.

Stand. A general descriptive term referring to an aggregation of trees, standing on a limited area, of more or less uniformity of composition and condition, or of age.

Tolerant. Capable of enduring more or less heavy shade.

Tree class. All trees of approximately the same size.

Seedling. A tree not yet 3 feet high.

Small sapling. A tree from 3 to 10 feet high.

Large sapling. A tree 10 feet or over in height and less than 4 inches d.b.h.

Small pole. A tree from 4 to 8 inches d.b.h.

Large pole. A tree from 8 to 12 inches d.b.h.

Standard. A tree from 1 to 2 feet d.b.h.

Veteran. A tree over 2 feet d.b.h.

Wolf tree. A tree occupying more space than its silvicultural value warrants, curtailing better neighbors.

B.

STAND IMPROVEMENT PROJECT PLAN
MASSACK AREA
PLUMAS NATIONAL FOREST

I. PURPOSE

- (a) To so treat the area by cleaning, thinning, sanitation, or other necessary cutting that the rate of growth and the value of the remaining stand will be materially increased.
- (b) To gather information as to methods, organization, equipment and costs to serve as a guide for future work of this kind.
- (c) To originate the collection of data which should be of future scientific interest.

II. LOCATION

The Massack area lies largely in T24N R10E MDM. It is a short distance north of the Quincy-Reno Highway, six miles east of Quincy. Much of the area is accessible by automobile.

III. TIME

Operations will be carried on through the coming summer (1934) and continued into the autumn as long as the weather permits, or until the work on the proposed area is completed.

IV. DESCRIPTION OF THE AREA

The Massack area is drained by Massack, Taylor, and Dry Taylor Creeks, all running in a southwesterly direction, and emptying into Greenhorn Creek. The latter is a branch of Spanish Creek, and part of the headwaters of the east branch of the north fork of the Feather River.

The general aspect is to the southwest though every exposure may be found on one or another of the various slopes. The per cent of slope varies from fifteen to sixty, with an average of about thirty; the elevation is between four and five thousand feet; and the site class is II and III, the better class usually being found on the higher slopes.

All of the west side types are found to some extent, ponderosa pine, ponderosa pine-sugar pine, ponderosa pine-sugar pine-Douglas fir-white fir-cedar, sugar pine-white fir, sugar pine-white fir-Douglas fir-cedar, ~~and~~ sugar pine-white fir. There is no pure sugar pine type of appreciable area.

The original timber stand is estimated to have been approximately 30 M feet B.M. per acre. The remaining mature stand is about 8 to 9 M feet B.M. The area is well stocked with reproduction, but it is difficult to estimate how much of it was established at the time of logging and how much has come in since. The height of this young stand varies from one foot to thirty feet or more. There are no extensive areas of one height class, as the heights vary considerably, depending upon the amount of nearby mature timber and other factors.

There are small, scattered islands of brush which may be considered negligible insofar as the work is affected. Oak also occurs scattered through the stand and in small patches as an overstory to conifer reproduction. The latter cases may demand some method of treatment.

The soil is medium to deep. Rock outcrops, points, or ridges are not common. The ground in the immediate vicinity of the creeks is rocky. Excessive erosion is not a problem on this area.

V. HISTORY

A Government sale of the timber in the Massack Creek drainage was made to the C. N. Cox Lumber Company in 1909 and logging was begun either in that or the succeeding year. Chutes were used for transportation of logs and horses furnished the motive power. Operations were continued by this method until about 1917, when steam donkeys and ground skidding were used for the remainder of the area in Taylor and Dry Taylor Creeks. No logging has been done here since 1923.

The Murphy fire of 1924 touched the western edge of the Taylor Creek cut-over. There is no evidence or record of other destructive recent fires on this area.

VI. SANITATION

Insect infestation is not abnormal for this vicinity. Only a few bug trees are noticeable. Many of the larger pines show the results of mistle-toe infection, and a certain amount of the seedlings, saplings, and poles need treatment. Many of the older white firs are conky, and practically all of the large old cedars show shot-hole cups.

Porcupine damage is not serious, apparently, but the area will be inspected in the near future by Mr. Hupe of the Biological Survey to determine whether or not control of these rodents is advisable.

VII. SELECTION OF STANDS FOR TREATMENT

The present plan is to work the whole area progressively. Probable areas to be eliminated because of poor stocking, brush, mature over-story of timber, or reproduction too small to justify treatment, are too small, three acres or less, to affect the working plan appreciably.

VIII. TREATMENT OF THE STAND.

The work on this area shall be done in accordance with the following standards:

- (1) Selection of leave trees (seedlings, saplings and poles).

(a) Select enough of the dominant and co-dominant trees to secure the desired spacing. As a guide to proper spacing distances follow the table given in STAND IMPROVEMENT INSTRUCTIONS. A rule of thumb approximating this is:

Allow 6 foot spacing for trees averaging one inch d.b.h.; and add one-half foot in spacing for each additional inch in d.b.h. For trees to be left under $4\frac{1}{2}$ feet in height the spacing should approximate their average height.

(b) Favor species in the following order: 1 - sugar pine; 2 - ponderosa pine; 3 - incense cedar; 4 - Douglas fir; and 5 - white fir.

(c) Remove defective trees (mistletoe, spike and broken tops, deformed bole, etc.) up to a 12 inch d.b.h. if better individuals will become dominants as a result.

(d) Remove fir up to 12 inches d.b.h. if there is a co-dominant or intermediate young pine which will clearly become dominant and occupy the space.

(e) Remove cedar up to 6 inches d.b.h. if there is a co-dominant pine which will become dominant and occupy the space.

(f) On those portions of the area upon which, due to a heavy reserve stand little or no release of advance reproduction has occurred, no thinning or clearing will be done.

(g) Cut nothing under 2 feet in height.

(h) A fundamental objective is to regain and maintain control of the ground by timber species. To this end no thinning will be done that will decrease the total area covered by thickets of advance reproduction. This means favoring individuals growing on the outside limits of such thickets.

(i) In cases where reproduction is reclaiming brush areas, no thinning will be done, since a heavier than normal stand will hasten the destruction of brush.

(2) Removals from the reserve stand (12" d.b.h. and larger).

(a) Remove all trees unmerchantable because of defect, regardless of size and all undesirable trees (broken, deformed, etc.) that can be utilized.

(b) Remove snags over 20 feet high and trees which will become snags within five years.

IX. SLASH DISPOSAL

The method of slash disposal will vary with ground conditions. The slash which must be disposed of by burning will be burned currently while the weather permits such a method without risk. During the fire season the labor involved in slash disposal will be restricted just as much as is consistent with the normal risk assumed by the Forest Service in connection with other activities, such as right-of-way clearing, etc.

In weeding work, when small openings are found at fairly frequent intervals, the trees cut will be scattered in these openings without further treatment. Where openings do not occur regularly, and where the cutting is heavy, as for example where about 4,000 trees per acre are removed, saplings will be cut in two and piled for burning. Where openings do not occur regularly and the cutting is light, as for example where about 2,000 young trees per acre are cut, saplings will be cut in two and scattered, and poles will be lopped and scattered. The object of scattering is to get the slash as close to the ground as possible with a minimum of labor.

If cutting is done in dense pole stands, the tops will be lopped and the brush will be left where it falls. In such situations some scattering of brush may be done if it is considered necessary to prevent a ground fire from crowning.

In roads open to public use, slash will be piled and burned on a strip from 100 to 200 feet wide along the road. This strip should be regulated as to width and location so that it will best serve as a fire-break.

X. CAMP ORGANIZATION

It is proposed to establish a camp for thirty men on Taylor Creek. This will include one camp superintendent, four foremen (two of whom are assistants to technician), one cook, one flunkey, one bull cook; and twenty-two laborers, four of whom should be able to fall timber. These laborers will be divided into two crews.

The location of the camp will be such that one crew will walk from camp to the job. The other crew will be transported to the outlying parts of the area by truck. With this arrangement no camp move will be necessary.

- (1) The men will work eight hours per day, five days per week, weather permitting.
- (2) Men will go to and from work on their own time.
- (3) A five minute rest period will be allowed in each working hour, at which time tools should be dressed.
- (4) Employees guilty of drunken or disorderly conduct shall be discharged.
- (5) The camp shall be maintained in a clean and sanitary condition at all times.

- (6) No families will be allowed to reside in camp, or on Government land within one-half mile thereof.
- (7) The smoking regulation in effect on the Forest shall be observed.
- (8) Extreme care shall be taken at all times with fire.
- (9) A tool cache shall be maintained in camp for fire purposes only, to consist of 20 L.H.R.P. shovels, 6 double-bitted axes, one falling saw with handles, two back pack pumps and cans.
- (10) Men will be required to remain in camp over week-ends only during periods of high fire hazard, as determined by the forest supervisor.
- (11) Men leaving camp at any time outside of working hours are expected to obtain the consent of the camp superintendent.
- (12) The time at which meals will be served will be determined by the camp superintendent.

A tentative daily schedule follows: Breakfast at 6:30 A.M., men on job at 8:00 A.M., work until 12:00 Noon. One-half hour or one hour for lunch. Work until 4:30 or 5:00 P.M., depending upon length of lunch period. Supper at 5:45 P.M.

It is expected that C.C.C. camps will handle the bulk of the fire suppression work, but when the stand improvement crews discover a fire, or are nearest to a fire, they shall attack it immediately under the direction of the camp superintendent and/or the foreman, and remain until relieved. Wages for such fire suppression work shall be paid from the forest fire fund. Stand improvement crews should not be sent to fires outside their immediate vicinity, except when absolutely necessary, and then should be relieved as soon as possible.

XI. CREW ORGANIZATION

(1) Duties of Camp Superintendent:

- (a) To have complete responsibility for all camp activities.
- (b) To lay out work for crews.
- (c) To inspect working crews at least twice daily.
- (d) To authorize all orders for supplies or equipment.
- (e) To supervise all cost and equipment records.
- (f) To see that all progress reports and maps are kept up to date.
- (g) To submit to the forest supervisor a monthly report of work accomplished.
- (h) To submit reports and records necessary for forest fiscal and administrative purposes.
- (i) To take charge of original action on any fires occurring on which such action is necessary.

(2) Duties of Technical Assistants

- (a) To take active charge of a crew of 10 or 12 men on actual cutting and slash disposal operations; or
- (b) To take care, at the direction of the camp superintendent, of any or all of the duties listed below:

- 1 - Run boundaries
- 2 - Prepare progress maps and maintain them up to date.
- 3 - Maintain cut and leave records.
- 4 - Keep records of equipment, costs; make out time slips, etc.
- 5 - Mark reproduction for cutting during training period of crew.
- 6 - Mark bug and sanitation trees, snags, etc., to be felled.
- 7 - Relieve camp superintendent of as much detail work as possible.

(3) Duties of Foreman

- (a) To have active supervision of a cutting and slash disposal crew of 10 to 12 men, alternating when possible with technical assistants.
- (b) To retain charge of their crews during fire suppression work.

The actual stand improvement work will be done by two crews of 10 to 12 men each. It is advisable to select men with previous woods experience but it is not necessary. If a fair number of the crew can identify the tree species, the remainder can soon be taught. Brush hooks have proved to be the most effective tool used to date, and men accustomed to axes are prejudiced until they have given the hook a thorough tryout. Axes are most convenient for slash disposal work.

The cutting work will be carried on by strips, each cutter taking a strip approximately one-half chain wide, and guiding himself on the man to the right or to the left, as the case may be. The crew will consist ordinarily of seven cutters and four men handling slash, but this arrangement will vary as the work demands. A cutter may be put on slash disposal for a day or so, or vice versa, and when any timber falling is necessary the men will be taken from one or another of these groups. The foreman is not expected to do any cutting, but he should be with his crews at all times to see that efficiency is maintained, and to answer any questions that may arise. He should carry a double-bitted falling axe for use by the cutters on poles selected for removal which are too large in diameter for brush-hooks, and not large enough to be taken care of by the fallers.

Keeping tools sharp is a problem, as they should be touched up several times a day. If left to the individual judgment of the cutter, much time can be wasted. For that reason a five-minute rest period will be given during each working hour, at which time the men can dress up their cutting tools.

XII. RECORDS OF COSTS AND ACCOMPLISHMENT

As one of the important phases of this work is to obtain data on costs, methods, organization and equipment to serve as a guide for future work, the records should be as complete as possible. One of the most important items is the segregation of time by activities. Camp superintendents, assistant technicians, and foremen, should record daily the amount of time each spends on various duties, such as supervision of cutting, slash disposal or falling; boundary running, marking, cut and leave cruising, record keeping, or other office work, etc. This may be done conveniently on timber sale administrative cost forms, No. 822-a, with a few corrections. The time of laborers will fall into three classifications, cutting, slash disposal, or falling, and should be segregated in the time books. The time of the cook and flunkey can not very well be distributed and may be carried as part of the subsistence costs. The bull cook's time may be carried as overhead, unless the time can be roughly distributed, i. e., cutting wood for cookhouse charged to subsistence, rehanging or sharpening tools, etc., to cutting, or slash disposal.

Any trees or snags to be removed from the mature stand are marked by a linen shipping tag with a wire hook. The tag is labeled, showing species, size, and reason for cutting. The fallers retain these and turn them in to the foreman at the end of each day's work, at which time he should enter the data on a record sheet.

Aside from the segregation of time by activities there are a number of good reasons for keeping fairly detailed records on this project. The work may be more intelligently planned and the men better distributed if a map is prepared in advance of actual cutting. This map will show areas to be worked, and not to be worked, and will distinguish between different types of stands in which work is to be done. The same map will serve as a progress map to measure accomplishment in terms of net acreage, and when correlated with costs should give us information useful in planning the work not only in this project, but on proposed projects with comparable conditions.

A check on the actual work accomplished by the cutters and the degree to which instructions regarding selection of trees and spacing are being adhered to can probably best be obtained by establishing semi-permanent sample plots upon which a tally will be made both before and after cutting is done. A comparison of the two tally sheets should give a good picture of what has been done to improve the stand.

The field procedure best adapted to getting this information is yet to be developed. It is the first job on the list and should receive a great deal of thought and attention by men right on the ground. Several possible methods will be tried out and tested as to the usefulness and adequacy of the information secured in relation to the expense of securing it.

A PLAN FOR STAND IMPROVEMENT WORK ON THE "MINERS DITCH SALE"

Stanislaus National Forest

I. PURPOSE OF PROJECT

To release sugar pine, ponderosa pine, and incense cedar saplings and poles from destructive competition with fir species and with each other. The aim should be to produce a mixed forest of well-spaced dominants of the above species. The cleaning should be done with the idea of stimulating growth for a period of approximately twenty years.

II. LOCATION AND TIME OF PROJECT

The area selected for stand improvement is known as "The Old Miners Ditch Sale". It is located in Townships 4 and 5 north, Range 18 east, Stanislaus National Forest, as shown on the attached map.

The work will be done during the field season of 1934. It should start May first, or before, and last well into November.

III. DESCRIPTION OF AREA AND STAND

The area is situated between the Middle Fork and the South Fork of the Stanislaus River. The altitude ranges from 5000 to 6000 feet. The general slope is northwest to the Middle Fork. It is broken up by the sub-drainage, into north, south, east and west exposures. The slopes are moderate to steep. A large part of the area consists of benches and moderate slopes on which the sites are Class I and Class II. The poorer sites are found on the ridge tops and steep slopes.

The original stand was probably 40 M. B. M. per acre and the residual stand is about 10-12 M. B. M. per acre. The forest types are sugar pine-fir, sugar pine ponderosa-pine and some pure ponderosa pine and pure white fir. The residual stand of large trees is irregularly distributed. The advance growth occurs in scattered groups. Its release is better in the larger openings. Under groups of large trees it is growing slowly. From 10 to 15 per cent of the advance growth is pine and the remainder white fir and incense cedar. It was established prior to logging and is now about thirty years old and from 2 to 20 feet high. Some reproduction has come in since logging, mostly on abandoned railroad grades and cuts.

IV. HISTORY OF AREA

The area was logged with donkeys during the period 1920-1926. Brush has come in on the upper and dryer slopes. There are a few snags and oaks on the area.

The logging operation destroyed some of the advance growth and reduced the size of the groups. The slash on the greater part of the area was lopped and scattered at the time of logging. The area has been intensively protected and no fires have occurred.

No insect infestation has occurred on this area.

Stand improvement work has been done on 560 acres of the project in 1933. It consisted of the releasing of seedlings and saplings from competition.

There are some scattered groups of pole stands on this area which can be worked.

V. SELECTION OF STANDS FOR TREATMENT

Well stocked stands on good sites will be selected for treatment. Stands which are reclaiming brush fields will not be worked. Stands of old growth trees, stands on poor sites, and stands of white fir will not be treated.

Areas within walking distance of Camp Bumblebee will be worked first. These include the better stands and will connect up with areas previously worked.

Stands selected for treatment and stands on which no work will be done are shown on the attached map. The order in which the work will progress is also shown.

VI. TREATMENT OF STANDS

- (1) Treatment of stands in the seedling and sapling stages will consist of cleaning as defined in the general instructions.

Treatment of pole stands will consist of improvement cutting as defined and sub-divided in the general instructions.

Treatment of old growth stands will consist of sanitation cuttings as defined in the general instructions.

The governing principles described in the general instructions will apply to spacing. The rule of thumb mentioned and the table given in the general instructions will be used as guides and checks.

- (2) The following special instructions dealing with groups of young trees and taking into account (a) species, (b) dominance, (c) form, and (d) adaptability to site, will apply to the local conditions.

(a) Species

1 - Sugar Pine: Sugar pine, in general, is well adapted to the excellent site on which this work will be done. Throughout our forests, sugar pine reproduction is scarce, as compared to ponderosa pine and cedar reproduction. Because of its excellent growth habits and superior quality of wood produced, we are anxious to perpetuate sugar pine in our mixed stands. This area offers an excellent opportunity to do so. Therefore, good, strong sugar pine co-dominant or intermediate

trees should, in general, be marked for retention, even if this means cutting dominants of the other species to free them. In the same way, ponderosa pine good co-dominants should be retained rather than cedar dominants, when in competition for space.

Other things being equal, favor sugar pine over ponderosa pine and ponderosa pine over cedar. Cut the fir freely when it interferes with the growth of pines or cedar.

Occasional small thickets of well-developed white fir occur throughout the area. Small, suppressed sugar pine seedlings are generally found as an understory in these thickets. To free these seedlings, a light thinning in white fir thickets not over one-tenth of an acre in area should be made. This thinning will leave a large part of the dominant and co-dominant fir but will be designed to let in enough light to promote the growth of the sugar pine understory.

Complete, sudden exposure of sugar pine seedlings and saplings appears to be inadvisable. Some of the smaller seedlings and saplings soon acquire yellow foliage after thinning. Large, spindly saplings, left after the removal of supporting trees, tend to droop and will probably be very subject to snow injury the first year after thinning. In dealing with such trees, a companion tree, preferably a sugar pine or ponderosa pine, should be left to furnish support and protection. Such trees will do the most good if left on the south side. If only fir or cedar trees are available for support, they should be girdled near the ground below the lowest branches.

- 2 - Ponderosa Pine: This species is second only to sugar pine in importance and value on this site. When in competition with fir and cedar, good ponderosa pine dominants and co-dominants should be left.
- 3 - Incense Cedar: This species rates as less desirable than sugar and ponderosa pine on average sites and more desirable than white fir.
- 4 - White Fir: This species is considered the least desirable of the four dealt with in the plan because it produces inferior lumber which can not be sold at sufficiently high price to cover the cost of production. It is a very prolific, aggressive species and is inclined to take possession of the ground to the exclusion of other species. Because of this inferiority, cultural work in pure young fir stands, designed to improve the growth rate, or yield, of fir is not justified. Weeding and thinning in fir is desirable, however, when designed to increase the proportion of better species in the stand.

(b) Dominance

Except as explained above, select dominant trees for retention when well formed.

(c) Form

Select for retention straight, full-crowned trees as against somewhat taller trees of the same species which are abnormal in form.

(d) Adaptability to site

Remember that ponderosa pine and cedar are better adapted than sugar pine to hot, steep, south exposures. This factor may occasionally have some weight, but it is of only minor importance on this particular job.

(3) Sanitation work in treatment of old growth stands is mentioned above. It will be extended to cover sapling and pole stands.

VII. SLASH DISPOSAL

The slash will be lopped and scattered. Along motorways and trails it will be piled and burned, for a distance of 20 feet on each side of road.

VIII. SNAG DISPOSAL

Snag disposal is no special problem on this project. Where it is found to be desirable to fell snags along roads and ridges, the sanitation crew can do the work.

IX. CAMP ORGANIZATION

(1) One standard 30-man camp will be used for this project. It will include the following personnel:

1 Camp Superintendent
2 Assistant technicians
2 Straw bosses
1 Cook
1 Flunkey
1 Bull cook
4 Experienced laborers
18 Laborers

(2) The camp will be located on the site of the old Bumblebee logging camp. The best areas are within walking distance of this camp. The long corners can be worked by a small crew which can be transported in a "pickup" truck. One camp move may be necessary. This will be to a camp site on Cow Creek about where the creek crosses the lower road.

(3) Camp regulations

(a-b) Camp Schedule

6:00 A.M.	First bell
6:15 - 6:45	Breakfast
6:45 - 7:15	Travel to work
7:15 - 12:00	Work
12:00 - 1:00 P.M.	Noon hour
1:00 - 4:15	Work
4:15 - 4:45	Travel to camp
5:15 P.M.	Dinner
9:00 P.M.	"Taps"

(c) Sanitation

- 1 - Camp and kitchen inspection daily.
- 2 - Men will be required to use camp toilets and keep bunks and tents clean and orderly.
- 3 - The cook house crew will be held responsible for the care of the kitchen and mess-hall.
- 4 - The "bull cook" will be responsible for the care of the grounds, toilets and garbage pits.

(d) No families will be allowed in camp.

(e) Drinking and disorderly conduct will not be tolerated. If it occurs, the man will be warned or dismissed, depending on the case involved.

(f) Fire prevention:

- 1 - No smoking will be allowed outside of camp.
(Except at designated places.)
- 2 - Men will be instructed in danger of fire and need for continual care to prevent fire. This will be emphasized because of the volume of hazardous slash created by the work.
- 3 - A fire trail will be constructed around the camp.
- 4 - Camp will be watched at all times.

(g) A fire suppression plan to be approved by the forest supervisor will be prepared and a copy kept in camp.

X. CREW ORGANIZATION

The camp will be divided into two main crews, which will consist of:

- 1 Assistant technician
- 1 Working straw boss
- 2 Experienced laborers
- 9 Laborers

Each crew will be assigned a block to work, subdivided as may be necessary.

Camp Superintendent

The camp superintendent will be directly responsible to the forest supervisor or his assistant. He will have direct supervision over all phases of the work and will be responsible for the proper conduct of the camp and project. He will act on suggestions given by inspectors from the regional office or experiment stations. (Note: Such suggestions should be followed by memo to cover any changes in instructions and copies sent to supervisor and camp superintendent.)

The superintendent should keep in close contact with the work and inspect camp and crews daily. He should be given the power to hire and discharge men and purchase supplies needed in the camp. He will prepare progress and technical reports, plans for future work, etc., as requested.

The Assistant to Technician will be directly responsible to the superintendent. His duties will vary with his capabilities and the character of the work. In some areas he may take direct charge of a marking crew at times, although generally his duties will be of a technical nature, such as:

- (1) Stripping the area in advance of work to determine the composition of stands as a basis for planning.
- (2) Segregating and mapping stands to be marked.
- (3) Advising the straw boss and marking trees for cutting when marking is necessary.
- (4) Gathering data for reports, preparing reports, maps, etc., as directed.

The Straw Boss will be in direct charge of the men. He will divide his crew to fit the work at hand and be responsible for the individual performance of the men. He will be responsible to the superintendent, but should cooperate with and accept technical advice from the assistant technician. He will keep the time for himself and crew and segregate it according to instructions from the superintendent. He will work as a crew member when not otherwise engaged.

The Experienced Laborers will be assigned special work in advance of the crews which may be necessary. Such work may include the removal of larger trees for sanitation purposes, or snag disposal. In the absence of such work the experienced laborers may act as crew leaders.

The Laborers will be directly responsible to the straw boss.